International Commission on Nomenclature was rendered in August, 1910, in favor of restricting *Astacus* for the crayfishes and *Homarus* for the lobsters, it is hoped that this needless source of misunderstanding will be eventually removed.

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## A PANUM INCUBATOR WITH IMPORTANT MODIFICATIONS

ONE of the most pressing needs of a general bacteriological laboratory is an incubator which possesses compartments of different but constant temperatures. Various types have been constructed and are in use to-day. After a rather extended investigation into the subject of incubators the writer chose the so-called "Panum" model with certain modifications. An admirable description of this incubator, together with certain improvements which it has undergone in the Carlsberg laboratory, is given in Klöcker's "Fermentation Organisms."[1] A brief description seems desirable here, in order to impress upon those who are not familiar with the apparatus its salient characteristics.

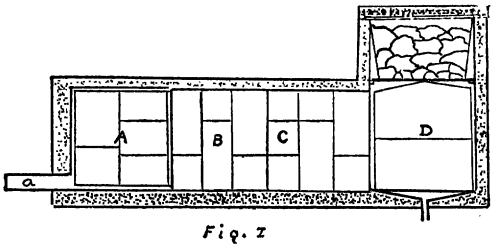


Fig. 1

The incubator consists of three main parts (Fig. 1, *A*, *B–C*, and *D*) which are constructed separately, preferably of thick sheet metal. These three parts are soldered together. The first compartment, *A*, is double-walled. The space between the two walls is filled with water, which is kept at the required temperature by a safety gas lamp which is controlled by a thermo-regulator (*b*). The gas lamp is placed under a projecting wing (*a*) of the outer metal wall. As this wing may burn through in the course of time it is connected with the water jacket by means of screws and flanges which are provided with rubber packing. The projecting wing may be replaced when necessary, without any difficulty. The space between the two walls of *A* is filled with water poured in through holes in the top. The water may be run off through a stopcock situated on the wing.

Compartment *A* is divided into halves by a vertical partition. Division *B–C* is divided into two compartments each of which is subdivided into three equal sections by vertical metal partitions. All of the divisions are provided with two shelves which may be placed at any desired height. The last main compartment, *D*, serves as a refrigerator. It possesses an inner receptacle, the roof of which slopes to the sides and back. This inner box is cooled by water which trickles down over it from ice which is held on a strong grating. The water is run off through an opening in the floor of the main compartment. The ice container is covered with a metal lid over which a thick wooden lid is made to fit closely.

The entire apparatus, with the exception of the front, is covered by a layer of felt 8 centimeters thick and enclosed in a wooden box.

In the words of the book, "Each of the spaces 1 to 8 is provided with a tightly fitting glass door, and doors of sheet iron are fitted on each of the four large compartments, *A*, *B*, *C* and *D*, which are closed tightly by pressing against rubber strips fitted on the partitions. Four corresponding doors, also fitting tightly, are attached to the wooden case, their inner sides being coated with woolen pads. All these doors are hinged below, and when opened and resting in a horizontal position on adjustable brackets may be used as tables."

In the particular incubator under consideration it seemed desirable to make a number of changes or improvements over the model just described. In the first place, heavy copper sheeting was used throughout the apparatus, with the view, of course, of making all the parts more permanent. Besides soldering the three separate divisions

[1] Published by Longmans, Green & Co., London and New York.

together, they were fastened together with bolts or rivets. This makes it impossible for the parts to draw apart and thus greatly reduce the efficiency of the entire incubator.

The greatest departure from the original was made in the construction of the doors. The large doors opening out on hinges at the bottom seemed highly objectionable from the standpoint of convenience for those who regularly make use of the apparatus. Instead of providing each of the four main compartments with two single doors, one set of double doors was fitted to each division. These doors are made of heavy copper sheeting, and are two-walled. They are about three inches thick, and are so constructed as to fit perfectly into the fronts of the respective compartments, and to come together in such a way as to allow of no appreciable diffusion of heat. They swing on hinges at the sides of the divisions. The hinges are firmly attached by a special device. The doors are made to close tightly by means of fasteners situated at the tops and bottoms. Besides the single pair of doors for each large division, each small compartment is provided with its own movable glass door, as in the original model. The two-walled thick outer door, which is filled with air space, makes a third door unnecessary.

The approximate dimensions of the incubator are as follows: Length (outside measurement), 8 feet and 9 inches; height (not including ice box), 2 feet and 9 inches; width, 2 feet and 6 inches. Inside measurements of individual compartments: Divisions in section *A*, each 11 inches wide and 23 inches high; separate compartments in sections *B* and *C*, 8 inches wide and 23 inches high; and the inner receptacle or box in the refrigerator division, 23 inches cube.

The incubator rests on a strong wooden stand which is 30 inches high. At the refrigerator end there is a specially constructed platform by means of which the ice carrier has easy access to the ice box. To further facilitate the replenishing of the ice supply, the outer lid of the ice box has attached to it a stout cord, to the further end of which a heavy iron weight is fastened. The cord passes over a pulley which is fixed to the ceiling of the room.

The apparatus has been in operation for almost a year, and has proved highly satisfactory. The temperatures in the different compartments have been practically constant, even when there were marked fluctuations in the temperature of the room. To obtain the maximum efficiency, however, the thermoregulator must be in good working condition, and the ice supply must be replenished at regular intervals. The incubator has been in operation during the warmest summer season as well as in the coldest winter months, with but very slight variations in the inner temperatures, except during a few days of last summer when the temperature of the room was far above blood heat.

Aside from tests made by myself frequently, a rather exhaustive investigation of the constancy of the temperature of the different compartments was made by certain members of the Yale biological department in connection with their determination of the temperature coefficient of the rate of reproduction of *Paramecium aurelia*.[2] The temperature in each compartment was recorded by a tube thermometer, a maximum and minimum registering thermometer, and in one chamber also by a thermograph. In their report of the investigation we find the following statements.

> The temperatures of the various compartments were not only kept practically constant, but, which is more important from the standpoint of these experiments, the very slight variations which occurred, appeared practically the same in all the compartments simultaneously.

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## A convenient 20° incubator

An incubator that will work satisfactorily with gelatin culture media during the hot summer and in our usually superheated laboratories in winter is a great desideratum. A number of expensive devices of this character

[2] Woodruff and Baitsell, *American Journal of Physiology*, XXIX., 147–155, 1911.